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CEREAL LEAF BEETLE, *OULEMA MELANOPUS* (L.) (COLEOPTERA: CHRYSOMELIDAE): DENSITY AND PARASITOID SYNCHRONIZATION STUDY IN WASHINGTON COUNTY, MARYLAND 1977-1979[1]

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Abstract.—A three year study was begun in 1977 to study population densities of *Oulema melanopus* (L.) and its parasitoids and the synchronization of their life histories. The egg parasitoid *Anaphes flavipes* (Foerster) and the larval parasitoid *Tetrastichus julis* (Walker) were the most abundant parasitoids. Both species reached peak populations approximately one week after *O. melanopus*. Overall parasitization was 44.7% of the eggs and 8.3% of the larvae.

Oulema melanopus (L.) was first identified from Michigan in 1962. Since then this pest of small grains has spread through the eastern United States (Haynes and Gage, 1981). In 1963 the United States Department of Agriculture (USDA) began a survey of the parasitoid complex of *O. melanopus* in Europe (Dysart et al., 1973). This resulted in the introduction and establishment of four parasitoids (Maltby et al., 1971; Stehr, 1970; Stehr and Haynes, 1972; and Stehr et al., 1974). This complex is composed of the egg parasitoid *Anaphes flavipes* (Foerster) (Hymenoptera: Mymaridae); and the larval parasitoids *Tetrastichus julis* (Walker) (Hymenoptera: Eulophidae), *Diaparsis temporalis* Horstmann, and *Lemophagus curtus* Townes (Hymenoptera: Ichneumonidae). In 1977, a study was begun to determine the population density of *O. melanopus* and the density and life history synchronization of the parasitoids.

MATERIALS AND METHODS

Ten oat (*Avena sativa* L.) fields, larger than 1.2 ha, were selected within the 160 km^2 study area. Washington County was chosen as the study area because it had the highest acreage of oats in the infested area of Maryland. Each field was divided into 10 plots. Weekly collections were made of all *O. melanopus* eggs and larvae from 52 cm of row in all of the 10 plots in each field.

The eggs were rolled off the leaves using a probe and placed in a 50 × 9 cm petri dish, with a maximum of 50 eggs per dish. A piece of moistened filter paper was placed in each dish to prevent dessication. The eggs were held in the laboratory

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Table 1. Population density of *Oulema melanopus* and its parasitoids in Washington County, Maryland 1977.

Week	No. eggs	No. parasitized	% parasitized	Mean % parasitism	No. larvae	No. parasitized	% parasitized	Mean % parasitism
2	230	8	3.47	3.5 ± 6	49	0	0	0
3	331	40	12.08	21.8 ± 17.66	82	1	1.21	1.33 ± 2.3
4	578	262	45.32	39.4 ± 22.8	177	1	0.56	0.25 ± 0.5
5	565	422	74.69	79.85 ± 15.44	164	13	7.92	24.33 ± 34.37
6	512	476	92.29	92.66 ± 4.09	77	7	9.09	7.44 ± 13.35
7	402	374	93.03	93.37 ± 6.23	26	12	46.15	13.62 ± 24.41
Total	2618	1582	60.42	62.3 ± 21.6	575	34	5.91	24.82 ± 32.14

at 21°C for 7 days. If the eye spots of *A. flavipes* pupae were not visible by this time the egg was considered non-parasitized (Anderson and Paschke, 1968).

Larvae were placed in vials of 15% ethyl alcohol with a maximum of 50 larvae per vial. The vials were held at 0°C until the larvae were dissected under a binocular microscope. Parasitoids were identified using Montgomery and DeWitt (1975).

Surveys started on approximately 1 May each year. The earliest planted field was checked 7 days prior to the starting date to see if *O. melanopus* activity had begun. The surveys continued until after peak larval population.

Results and Discussion

The survey began as scheduled in 1977 and 1978. In 1979 adult activity was sufficient to start on 23 April. Surveys were conducted for 6 weeks in 1977, 7 weeks in 1978, and 9 weeks in 1979. Fields were lost from the survey in 1977 (one plowed between weeks 3 and 4) and 1979 (2 harvested as green silage between weeks 8 and 9).

The results of the survey are summarized in Tables 1–3. In 1977 and 1978 all recovered larval parasitoids were *T. julis*.

In 1979 three larvae were recovered parasitized by *D. temporalis* and four by *L. curtus*. From these results it is apparent that *D. temporalis* and *L. curtus* are not significant mortality factors to *O. melanopus* populations in Maryland.

Table 2. Population density of *Oulema melanopus* and its parasitoids in Washington County, Maryland 1978.

Week	No. eggs	No. parasitized	% parasitized	Mean % parasitism	No. larvae	No. parasitized	% parasitized	Mean % parasitism
2	116	0	0	0	0	0	0	0
3	206	0	0	0	0	0	0	0
4	248	6	2.41	1.2 ± 3.79	5	0	0	0
5	572	38	6.64	8.91 ± 10.28	45	1	2.22	3.33 ± 10.53
6	1131	349	30.85	36.65 ± 26.79	170	28	16.47	19.42 ± 18.76
7	1085	875	80.64	85.27 ± 15.91	314	19	6.05	12.81 ± 14.72
8	647	529	81.76	80.88 ± 20.58	101	22	21.78	32.42 ± 28.38
Total	4005	1779	44.41	47.58 ± 12.16	635	70	11.02	15.67 ± 17.05

Table 3. Population density of *Oulema melanopus* and its parasitoids in Washington County, Maryland 1979.

Week	No. eggs	No. parasitized	% parasitized	Mean % parasitism	No. larvae	No. parasitized	% parasitized	Mean % parasitism
1	443	1	0.22	1.38 ± 3.92	0	0	0	0
2	1243	25	2.01	2.32 ± 5.22	0	0	0	0
3	1742	19	1.09	1.71 ± 1.73	28	0	0	0
4	2021	225	11.13	16.82 ± 11.46	813	33	4.05	7.36 ± 9.66
5	2120	1294	61.03	63.49 ± 12.25	1089	53	4.86	5.80 ± 5.27
6	2048	1714	83.69	84.25 ± 6.92	1162	63	5.42	5.59 ± 4.51
7	1497	1338	89.37	91.33 ± 5.99	566	49	8.65	8.31 ± 7.96
8	297	285	95.95	97.36 ± 2.63	113	102	90.26	91.25 ± 6.84
9	23	21	91.30	80 ± 27.38	9	9	100	100
Total	11,434	4922	43.04	41.30 ± 11.24	3780	309	8.17	11.31 ± 6.92

A. flavipes is a significant mortality factor of *O. melanopus* in Maryland. Lee and Barr (1976) and Dysart (1971) report that it is poorly synchronized with *O. melanopus* and that *A. flavipes* populations are low in the early part of the season but rapidly increase. Synchronization with *O. melanopus* is good; at the peak density of *O. melanopus* eggs, *A. flavipes* parasitized between 30% to 84% during the 3 year period. Peak *A. flavipes* populations occur about 1 week after peak *O. melanopus* egg density.

Populations of *T. julis* were present throughout the study area but the percent parasitism was low when *O. melanopus* populations were high. The high rate of parasitism.by this parasitoid observed in late season *O. melanopus* larvae is similar to that reported by Gage and Haynes (1975). The parasitoid population increased over the three year period but did not match the population increase of *O. melanopus*, even though *T. julis* has a high reproductive potential (Haynes and Gage, 1981). Haynes (1973) hypothesized that the lack of population growth of *T. julis* is a result of *A. flavipes* parasitizing a high proportion of the late season *O. melanopus* eggs leaving very few to hatch into larvae for the second generation of *T. julis*.

In this survey an average of 85.7% (range 80–96%) of the eggs during the last two weeks were parasitized by *A. flavipes*. While the numbers of *T. julis* adults active in the field were not recorded in the last two weeks the results present strong circumstantial evidence supporting Haynes' (1973) hypothesis.

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